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ENVIRONMENTAL LEVELS OF RADIOACTIVITY
FOR THE OAK RIDGE AREA

Report for First Quarter, 1960

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This document has been approved for release
to the public by:

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Introduction

This report is based on a continuation of the monitoring program described in "Environmental Levels of Radioactivity for the Oak Ridge Area, Report for 1959", dated May 28, 1960. The method and techniques which were described in the previous report have been used in the preparation of this information.

Discussion of Data

Data on the environmental levels of radioactivity for the first quarter of 1960 in the Oak Ridge and surrounding areas are presented in Tables I through IX.

The air contamination level shown by the continuous air monitoring filter data for the immediate and remote environs of the plant was 0.11% of the maximum permissible concentration for populations in the neighborhood of a controlled area. There were no large fluctuations in the levels measured during the period and levels did not vary significantly from background levels measured by the U. S. Public Health Service in other areas of the United States.

The probable average concentrations of radioactivity in the Clinch River at Mile 20.8, the point of entry of the wastes, and at Mile 4.5, near Kingston, Tennessee, were 10.3×10^{-7} $\mu\text{c}/\text{cc}$ and 7.8×10^{-7} $\mu\text{c}/\text{cc}$ respectively. These values are 26.9% and 16.4% of the weighted average maximum permissible concentration as recommended by the National Committee on Radiation Protection. The average concentration of transuranic alpha emitters in the Clinch River at Mile 20.8 was 8×10^{-11} $\mu\text{c}/\text{cc}$ which is 0.002% of the weighted average (MPC)_w value.

The average activity in Poplar Creek below the ORGDP for the quarter continues to represent only 0.02% of the maximum permissible concentration for natural uranium.

External gamma radiation in the Oak Ridge area averaged 0.017 mr/hr. This level does not differ significantly from the average of the levels measured throughout the United States by the Public Health Service Radiation Surveillance Network.

TABLE I

CONTINUOUS AIR MONITORING FILTER DATA

Units of 10^{-13} $\mu\text{c}/\text{cc}$ First Quarter 1960

| Station Number | Location | Number of Samples Taken | Maximum | Minimum | Average | % of (MPC) _a |
|--------------------|--------------------|-------------------------|---------|---------|---------|-------------------------|
| Perimeter Stations | | | | | | |
| HP-11 | Kerr Hollow Gate | 13 | 1.54 | 0.56 | 1.13 | 0.11 |
| HP-12 | Midway Gate | 13 | 1.36 | 0.59 | 0.98 | 0.10 |
| HP-13 | Gallaher Gate | 13 | 1.66 | 0.63 | 1.06 | 0.11 |
| HP-14 | White Wing Gate | 13 | 1.34 | 0.45 | 0.90 | 0.09 |
| HP-15 | Blair Gate | 13 | 2.99 | 0.48 | 1.31 | 0.13 |
| HP-16 | Turnpike Gate | 13 | 1.67 | 0.24 | 0.99 | 0.10 |
| HP-17 | Hickory Creek Bend | 13 | 1.83 | 0.29 | 1.21 | 0.12 |
| Average | | | | | 1.08 | 0.11 |
| Remote Stations | | | | | | |
| HP-19 | Norris Dam | 13 | 1.95 | 0.50 | 1.24 | 0.12 |
| HP-20 | Loudoun Dam | 13 | 2.69 | 0.18 | 1.17 | 0.12 |
| HP-21 | Douglas Dam | 13 | 1.86 | 0.66 | 1.07 | 0.11 |
| HP-22 | Cherokee Dam | 13 | 2.03 | 0.54 | 1.32 | 0.13 |
| HP-23 | Watts Bar Dam | 13 | 2.73 | 0.37 | 1.25 | 0.13 |
| HP-24 | Great Falls Dam | 13 | 1.92 | 0.59 | 1.19 | 0.12 |
| HP-25 | Dale Hollow Dam | 13 | 1.71 | 0.34 | 1.09 | 0.11 |
| HP-26 | Berea, Kentucky | 13 | 1.64 | 0.12 | 0.80 | 0.08 |
| Average | | | | | 1.14 | 0.11 |

* (MPC)_a is taken to be 10^{-10} $\mu\text{c}/\text{cc}$ as recommended in NBS Handbook 69, Table 4, p. 94.

TABLE II

CONTINUOUS AIR MONITORING FILTER DATA

Particles/1000 cu. ft. of Air Sampled

First Quarter 1960

| Station Number | Location | Number of Samples Taken | Maximum | Minimum | Average |
|--------------------|--------------------|-------------------------|---------|---------|---------|
| Perimeter Stations | | | | | |
| HP-11 | Kerr Hollow Gate | 13 | 0.22 | 0.00 | 0.05 |
| HP-12 | Midway Gate | 13 | 0.16 | 0.00 | 0.03 |
| HP-13 | Gallaher Gate | 13 | 0.12 | 0.00 | 0.02 |
| HP-14 | White Wing Gate | 13 | 0.16 | 0.00 | 0.03 |
| HP-15 | Blair Gate | 13 | 0.50 | 0.00 | 0.08 |
| HP-16 | Turnpike Gate | 13 | 0.19 | 0.00 | 0.03 |
| HP-17 | Hickory Creek Bend | 13 | 0.23 | 0.00 | 0.02 |
| Average | | | | | 0.04 |
| Remote Stations | | | | | |
| HP-19 | Norris Dam | 13 | 0.38 | 0.00 | 0.04 |
| HP-20 | Loudoun Dam | 13 | 0.22 | 0.00 | 0.02 |
| HP-21 | Douglas Dam | 13 | 0.16 | 0.00 | 0.03 |
| HP-22 | Cherokee Dam | 13 | 0.40 | 0.00 | 0.06 |
| HP-23 | Watts Bar Dam | 13 | 0.13 | 0.00 | 0.02 |
| HP-24 | Great Falls Dam | 13 | 0.20 | 0.00 | 0.04 |
| HP-25 | Dale Hollow Dam | 13 | 0.36 | 0.00 | 0.05 |
| HP-26 | Berea, Kentucky | 13 | 0.20 | 0.00 | 0.03 |
| Average | | | | | 0.04 |

TABLE III

GUMMED PAPER FALL-OUT DATA

Units of 10^{-4} $\mu\text{c}/\text{sq. ft.}$ First Quarter 1960

| Station Number | Location | Number of Samples Taken | Maximum | Minimum | Average |
|--------------------|--------------------|-------------------------|---------|---------|---------|
| Perimeter Stations | | | | | |
| HP-11 | Kerr Hollow Gate | 13 | 2.99 | 0.23 | 0.95 |
| HP-12 | Midway Gate | 13 | 3.31 | 0.15 | 0.97 |
| HP-13 | Gallaher Gate | 13 | 2.11 | 0.17 | 0.71 |
| HP-14 | White Wing Gate | 13 | 3.14 | 0.15 | 0.73 |
| HP-15 | Blair Gate | 13 | 3.45 | 0.14 | 1.30 |
| HP-16 | Turnpike Gate | 13 | 2.68 | 0.36 | 0.95 |
| HP-17 | Hickory Creek Bend | 13 | 2.93 | 0.06 | 0.67 |
| Average | | | | | 0.90 |
| Remote Stations | | | | | |
| HP-19 | Norris Dam | 12 | 2.39 | 0.04 | 0.64 |
| HP-20 | Loudoun Dam | 13 | 3.03 | 0.05 | 0.65 |
| HP-21 | Douglas Dam | 13 | 2.70 | 0.11 | 0.63 |
| HP-22 | Cherokee Dam | 13 | 2.90 | 0.08 | 0.57 |
| HP-23 | Watts Bar Dam | 13 | 3.38 | 0.02 | 0.65 |
| HP-24 | Great Falls Dam | 13 | 3.04 | 0.03 | 0.70 |
| HP-25 | Dale Hollow Dam | 13 | 1.65 | 0.05 | 0.59 |
| HP-26 | Berea, Kentucky | 13 | 1.54 | 0.16 | 0.51 |
| Average | | | | | 0.62 |

TABLE IV

GUMMED PAPER FALL-OUT DATA

Particles/sq. ft.

First Quarter 1960

| Station Number | Location | Number of Samples Taken | Maximum | Minimum | Average |
|--------------------|--------------------|-------------------------|---------|---------|---------|
| Perimeter Stations | | | | | |
| HP-11 | Kerr Hollow Gate | 13 | 118.00 | 0.00 | 13.92 |
| HP-12 | Midway Gate | 13 | 83.00 | 0.00 | 11.23 |
| HP-13 | Gallaher Gate | 13 | 109.00 | 0.00 | 13.46 |
| HP-14 | White Wing Gate | 13 | 114.00 | 0.00 | 13.31 |
| HP-15 | Blair Gate | 13 | 80.00 | 0.00 | 10.77 |
| HP-16 | Turnpike Gate | 13 | 117.00 | 0.00 | 14.15 |
| HP-17 | Hickory Creek Bend | 13 | 116.00 | 0.00 | 14.15 |
| Average | | | | | 13.00 |
| Remote Stations | | | | | |
| HP-19 | Norris Dam | 13 | 121.00 | 0.00 | 13.38 |
| HP-20 | Loudoun Dam | 13 | 104.00 | 0.00 | 12.77 |
| HP-21 | Douglas Dam | 13 | 105.00 | 0.00 | 14.08 |
| HP-22 | Cherokee Dam | 13 | 62.00 | 0.00 | 7.46 |
| HP-23 | Watts Bar Dam | 13 | 110.00 | 0.00 | 12.69 |
| HP-24 | Great Falls Dam | 13 | 63.00 | 0.00 | 7.85 |
| HP-25 | Dale Hollow Dam | 13 | 80.00 | 0.00 | 9.69 |
| HP-26 | Berea, Kentucky | 13 | 46.00 | 0.00 | 5.82 |
| Average | | | | | 10.47 |

TABLE V

RADIOACTIVITY IN RAIN WATER

Units of 10^{-7} $\mu\text{c}/\text{cc}$ First Quarter 1960

| Station Number | Location | Number of Samples Taken | Maximum | Minimum | Average |
|--------------------|--------------------|-------------------------|---------|---------|---------|
| Perimeter Stations | | | | | |
| HP-11 | Kerr Hollow Gate | 11 | 2.95 | 0.10 | 0.54 |
| HP-12 | Midway Gate | 11 | 1.54 | 0.15 | 0.56 |
| HP-13 | Gallaher Gate | 11 | 0.94 | 0.07 | 0.44 |
| HP-14 | White Wing Gate | 11 | 0.85 | 0.01 | 0.30 |
| HP-15 | Blair Gate | 11 | 0.90 | 0.22 | 0.43 |
| HP-16 | Turnpike Gate | 11 | 0.88 | 0.13 | 0.53 |
| HP-17 | Hickory Creek Bend | 11 | 1.35 | 0.13 | 0.48 |
| Average | | | | | 0.47 |
| Remote Stations | | | | | |
| HP-19 | Norris Dam | 11 | 3.73 | 0.00 | 0.71 |
| HP-20 | Loudoun Dam | 11 | 1.37 | 0.04 | 0.53 |
| HP-21 | Douglas Dam | 11 | 1.29 | 0.16 | 0.60 |
| HP-22 | Cherokee Dam | 11 | 1.48 | 0.13 | 0.46 |
| HP-23 | Watts Bar Dam | 11 | 1.68 | 0.18 | 0.58 |
| HP-24 | Great Falls Dam | 11 | 2.09 | 0.20 | 0.83 |
| HP-25 | Dale Hollow Dam | 12 | 1.01 | 0.23 | 0.52 |
| HP-26 | Berea, Kentucky | 12 | 5.77 | 0.07 | 0.99 |
| Average | | | | | 0.65 |

TABLE VI

PROBABLE AVERAGE CONCENTRATION OF RADIOACTIVITY
IN THE CLINCH RIVER AT MILE 20.8

Units of 10^{-7} $\mu\text{c}/\text{cc}$

First Quarter 1960

| Number of Samples Taken | Maximum | Minimum | Average | % of (MPC) _w |
|----------------------------|---------|---------|---------|-------------------------|
| 91 | 21.3 | 3.3 | 10.3 | 26.9 |

TABLE VII

AVERAGE CONCENTRATION OF MAJOR RADIOACTIVE CONSTITUENTS
IN THE CLINCH RIVER

First Quarter 1960

| Location | Sampling Period | Units of 10^{-8} $\mu\text{c}/\text{cc}$ | | | | Probable Avg. Concen. of Radiosactivity $\mu\text{c}/\text{cc} \times 10^{-8}$ | $(\text{MPC})^a_{\text{w}}$ 10^{-6} $\mu\text{c}/\text{cc}$ % of MPC |
|-----------------------|--------------------|--|-------------------|-------------------|-----------------------|---|---|
| | | Sr ⁹⁰ | Ce ¹⁴⁴ | Cs ¹³⁷ | Ru ¹⁰³⁻¹⁰⁶ | | |
| Clinch River | | | | | | | |
| Mi. 37.5 | 10/1/59 - 1/29/60 | 0.11 | 0.10 | * | * | * | 0.45 |
| Mi. 20.8 ^b | 12/28/59 - 3/27/60 | 0.67 | 1.62 | 1.48 | 44.75 | 3.45 | 103.2 |
| Mi. 4.5 | 11/4/59 - 1/27/60 | 0.91 | 0.36 | 0.41 | 69.68 | 0.86 | 77.5 |

^a Weighted average $(\text{MPC})_{\text{w}}$ calculated for the mixture using $(\text{MPC})_{\text{w}}$ values for specific radionuclides recommended in the NBS Handbook 69.

^b Values given for this location are calculated values based on the levels of waste released and the dilution afforded by the river.

* None detected.

TABLE VIII

EXTERNAL GAMMA RADIATION LEVELS

mr/hr

First Quarter 1960

| Station Number | Location | January | February | March | Average |
|----------------|---------------------------|---------|------------|-------|---------|
| 1 | Solway Gate | .018 | None taken | .015 | .017 |
| 2 | Y-12 East Portal | .018 | None taken | .012 | .015 |
| 3 | Newcomb Road Oak Ridge | .015 | None taken | .013 | .014 |
| 4 | Gallaher Gate | .025 | None taken | .018 | .022 |
| 5 | White Wing Gate | .019 | None taken | .014 | .017 |
| Average | | | | | .017 |

TABLE IX

CONCENTRATION OF RADIOACTIVITY IN POPLAR CREEK

First Quarter 1960

| Location of Point | Type of Analysis Made | No. of Samples | Units of 10^{-8} $\mu\text{c/cc}$ | | | | (MPC) _w | Percent (MPC) _w |
|----------------------|-----------------------|----------------|-------------------------------------|---------|---------|--------------------|--------------------|----------------------------|
| | | | Maximum | Minimum | Average | (MPC) _w | | |
| Upstream (East Fork) | Uranium Concentration | 13 | 7.0 | 1.6 | 4.4 | 2000 | 0.22 | |
| Downstream (Outfall) | " | 13 | 1.0 | 0.2 | 0.5 | 2000 | 0.02 | |
| Upstream (East Fork) | Total Beta Activity | 13 | 226.4 | 7.7 | 35.6 | 2000 | 1.8 | |
| Downstream (Outfall) | " | 13 | 129.2 | 27.9 | 74.7 | 2000 | 3.5 | |

Normal Sampling Frequency: Continuous sampling; composited over one week.